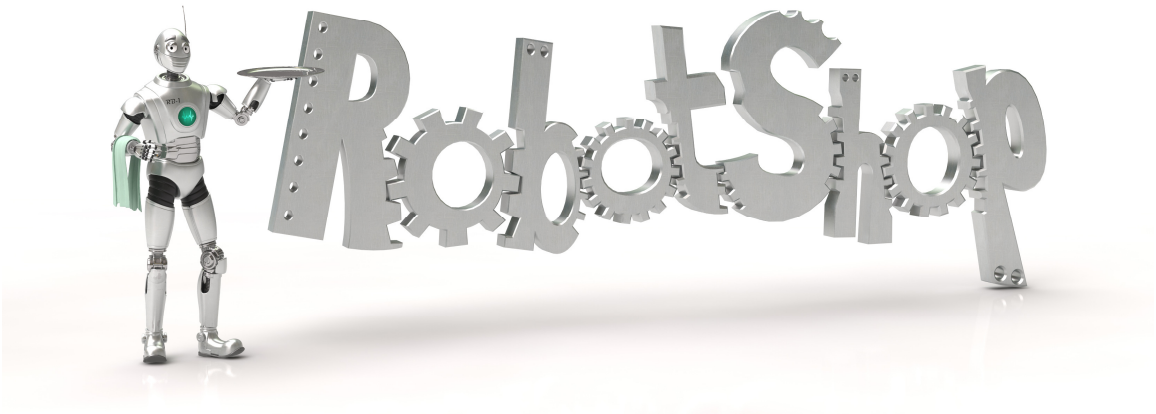

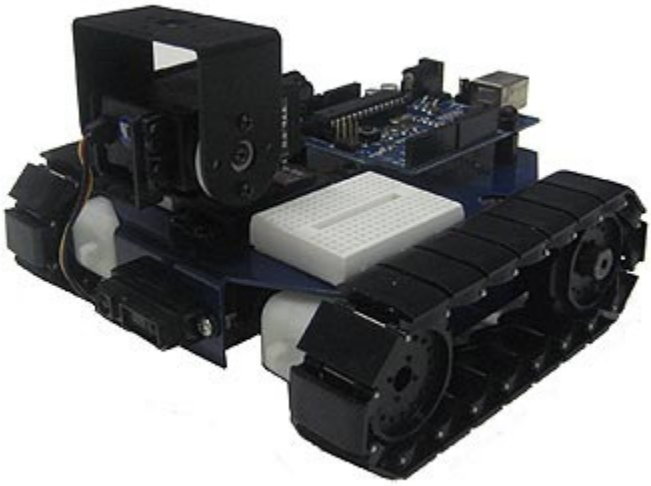

ROBOTSHOP ROVER DEVELOPMENT PLATFORM

User Manual v1.5

www.RobotShop.com

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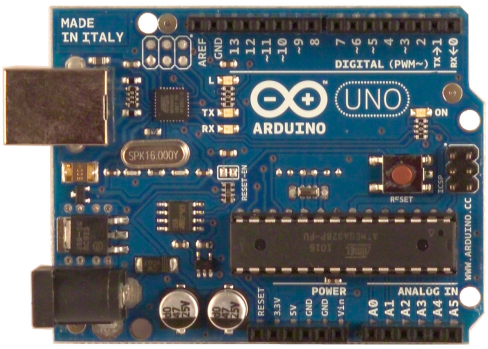
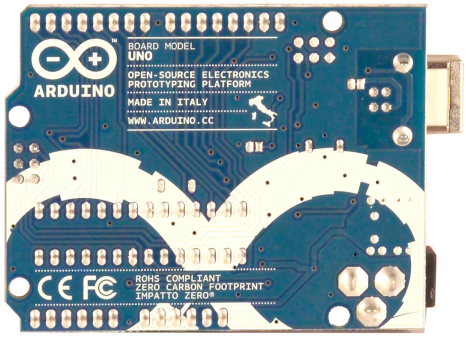
Specifications

Overall
Length: 160mm
Width: 155mm
Height: 65mm
Height (with pan/tilt): 95mm

Prototyping Surface
Length: ~120mm
Width: 100mm

Microcontroller
Arduino Duemilanove (discontinued)
Arduino Uno





Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Parts List

Basic Kit

The following parts are included with the basic platform kit:

- 1x Metal Frame
- 4x Phillips Screws
- 4x Nylon Snap Rivets (RB-Lyn-84)
- 2x Nylon F/F Standoffs (RB-Lyn-233)
- 2x Nylon Acorn Nuts (RB-Lyn-254)
- 2x 5/8" Nylon Screws (RB-Lyn-223)
- 1x 9V Battery Holder
- 2x Small Phillips screws
- 6x Rubber Spacers
- 1x Nylon Clip

Upgrade Kit

The following parts are included in the upgrade kit, along with all parts in the basic kit:

- 2x Pololu Motors (RB-Sbo-07)
- 1x Johnny Robot GM2/38/9 Track Kit (RB-Jon-10)
- 2x Shoulder bolts with fasteners and hex nut (RB-Pol-75)
- 1x AA Battery holder (RB-Spa-138)

Complete Kit

The following additional parts are included with the complete kit and include both the basic kit and upgrade kit.

- 1x Arduino Diecimilla (RB-Ard-03)
- 1x Sharp GPD12 Infrared Range Sensor (RB-Sha-01)
- 1x Sharp GP2 IR sensor cable (RB-Lyn-164)
- 1x Pololu Micro Dual Motor Controller (RB-Pol-16)
- 1x Lynxmotion Pan and Tilt Kit with Servos (RB-Lyn-74)
- 3x 170-tie point breadboard (RB-Spa-139)
- 1x 140 Piece Jumper Wire Kit (RB-Ibo-25)
- 1x #22 Gauge Hook-up wire (RB-Ibo-84)
- 1x Break-away headers (RB-Spa-153)
- 1x On/Off switch (RB-Spa-155)

Additional Parts Required

In order to build the complete kit, you will need the following additional (basic) tools:

- Wire cutter and wire stripper
- Soldering Iron
- Solder
- Phillips Screw Driver
- Allen Wrench Set
- Pliers
- 4xAA batteries (1.2V rechargeable or 1.5V alkaline)
- 1x 9V battery (unless the microcontroller can run off 4.8V)

Project Ideas

The basic rover is intended for you to add standard electronics in order to create a small autonomous or remote controlled rover. ***A basic understanding of electronics is required.*** Although the kit includes all essential parts to make an autonomous robot, it is intended to allow you to add your own electronics in order to satisfy your objectives. This robot differs from others in its size, versatility and cost. The front frame includes holes for the following parts:

RB-Sct-54 Servocity Servo Hub Horn (Hitec)
Can be used to attach custom parts to the front of the rover

RB-Lyn-99 Lynxmotion Mounting Hub
Can be used to mount tubing to the front of the robot

RB-Lyn-105 Lynxmotion Aluminum Multi-purpose Servo Bracket
This part is ideal for offsetting the arm to the very front of the robot, leaving the entire surface of the frame for electronics and breadboards.

RB-Lyn-106 Lynxmotion Aluminum L-Connectors can be used to mount items parallel to the frame either higher or lower such as the following:

RB-Lyn-75 Lynxmotion Aluminum Multi-Purpose Sensor Housing MPSH-01
Used to mount 3 sensors at various angles. This is particularly useful if you are using the pan/tilt system as the base for a robotic arm.

RB-Sum-13 Robotics Connection Sharp IR Turret
Allows you to more easily connect a variety of different sensors.

RB-Net-04 BasicX Development Kit
Instead of an Arduino, you can use a BasicX starter kit.

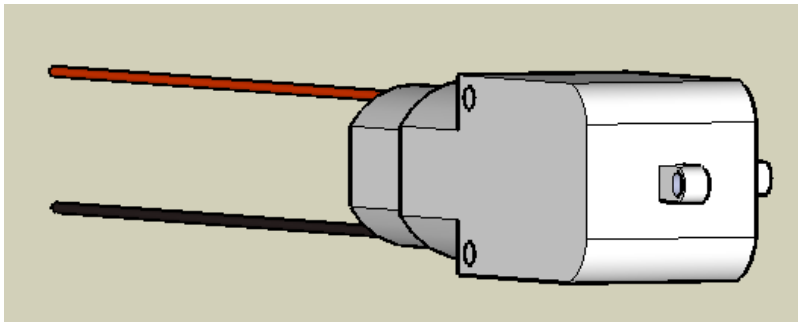
Assembly

Although you are encouraged to develop your own variation of the rover, this Assembly Guide will take you through the process of assembling the basic robot kit. The guide is intended to be used with the 3D CAD assembly Guide available online at www.robotshop.com.

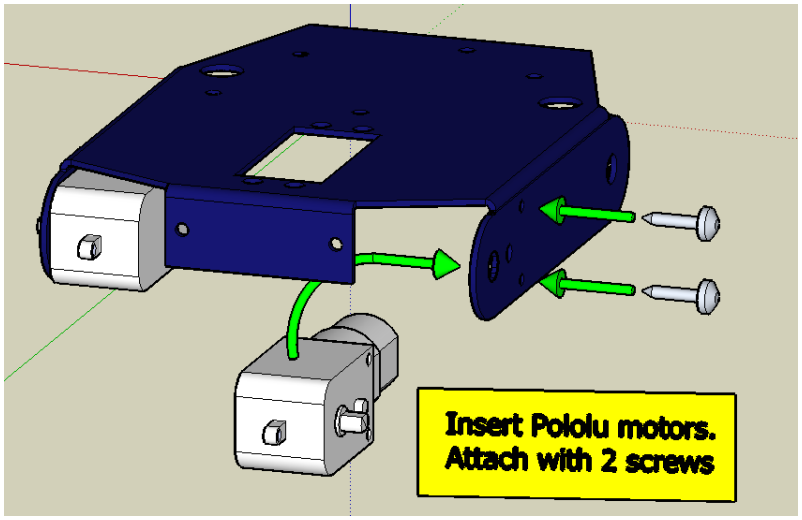
To view the 3D CAD file, you must download Google Sketchup. This is a FREE program available to download from http://sketchup.google.com The Assembly Guide was made using Google Sketchup 6. Note: In the 3D drawing, all parts are only roughly drawn in order to aid with the assembly process. To view the video, select View -> Animation -> Play.

Basic Platform

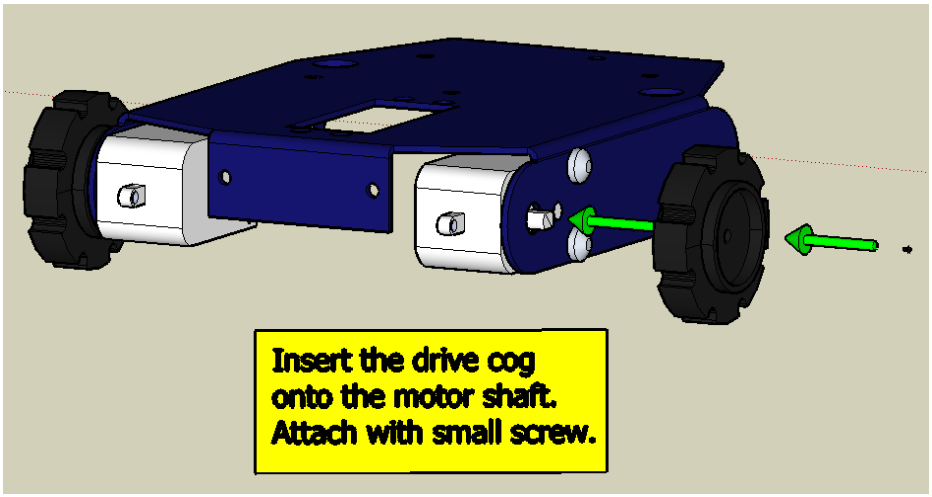
1. Prior to assembly, be sure to solder the motor wires to the motor. Should you have purchased the complete kit, you can use the #22 gauge wire and trim any unnecessary wire.



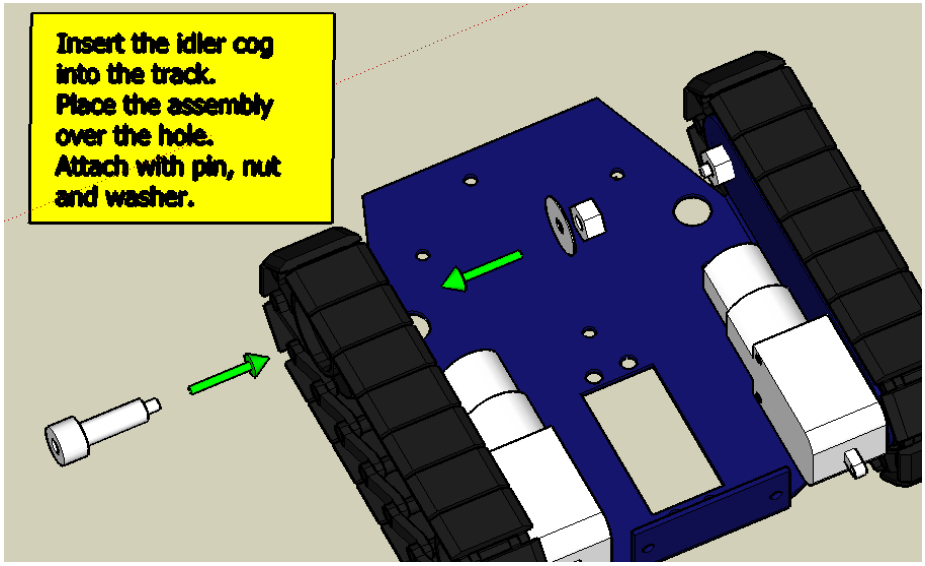
2. If you wish to modify the platform by adding custom holes, be sure to drill the holes with the frame on a flat surface, prior to any items being connected.
3. Insert the two motors into the frame and lock them in place using the Phillips screws.



4. Insert the drive cog onto the motor shaft and attach it with the small screw provided.

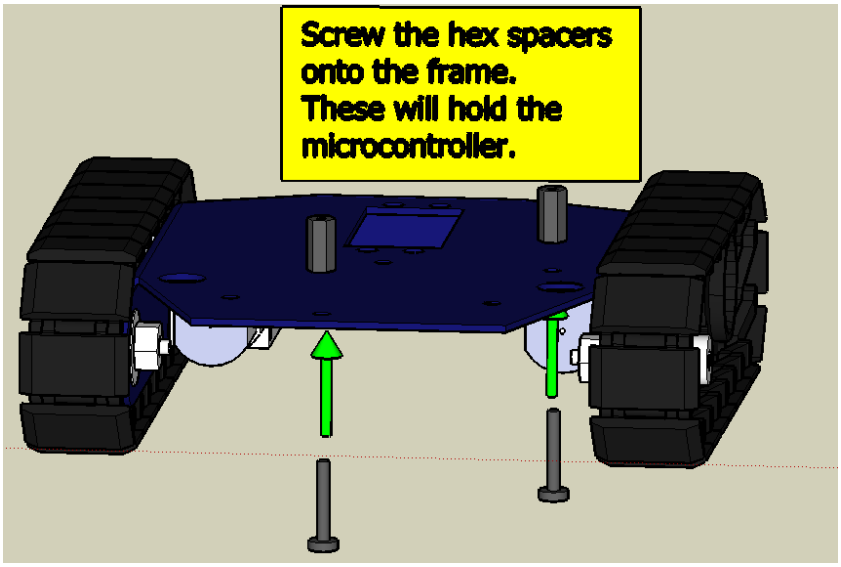


5. Assemble two sets of tracks with 20 links in each track.
6. Place the track on the drive sprocket and place the idler inside the track, in front of the connection point. Insert the Shoulder bolt through the idler sprocket and through the frame. Lock the idler in place with the washer and nut.

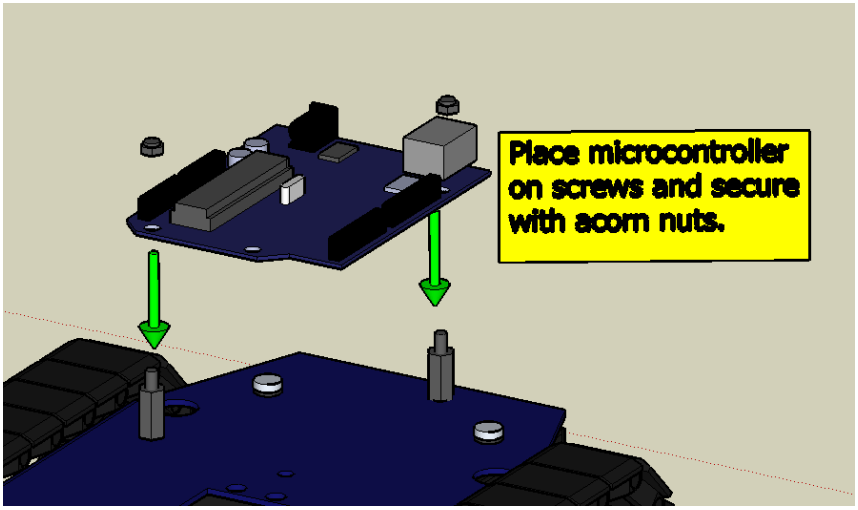


Microcontroller

1. Screw the hex spacers onto the frame using the screws and acorn nuts provided. Holes are available for the following microcontrollers:
    a. Arduino Diecimilla (center rear mounting)
    b. Arduino Diecimilla (right rear mounting)
    c. BasicX Development Board
    d. Parallax Java/Basic Stamp Board
2. Use the Nylon standoffs, acorn nuts and screws to hold your microcontroller in place. All microcontrollers are mounted at the rear of the robot.

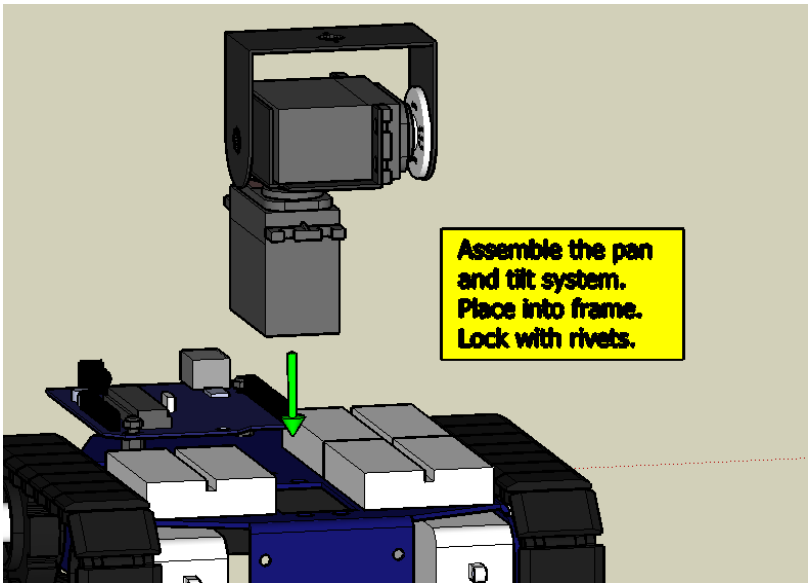


3. The acorn nuts though are used on top of the microcontroller, while the screws protrude from under the frame.



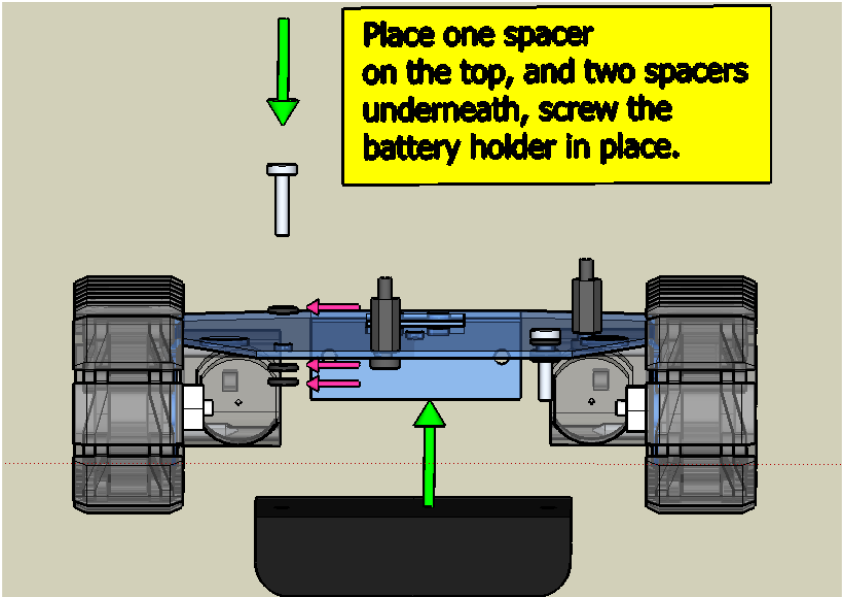
Servos

4. Use the snap rivets to hold the base servo in place.
5. Should your kit include the Lynxmotion pan and tilt system, follow the instructions on the Lynxmotion website for assembly.



6. All items connected to the horn of the base servo should be placed as far forward as possible to avoid interfering with items placed on either side of the servo.

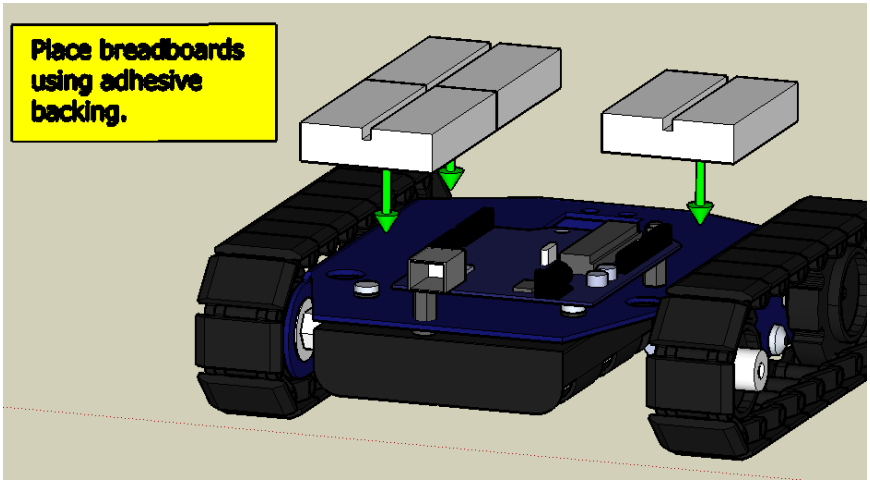
Battery Holders



1. Place one rubber spacer onto each of the Phillips screws.
2. Place these through the frame with the heads on the top of the frame.

3. Place two rubber washers onto the screw on the bottom of the frame.
4. Screw the screws into the holes in the battery holder (the screws will self-thread).
5. Place the small white nylon clip through the small rubber-o-ring, and then push both through the 9V battery holder. Push the assembly though the hole in front of the AA battery holder and glue in place (white glue or epoxy). All battery holders are located on the underside of the robot.

Breadboards



1. The design is configured to have all batteries and motors located on the underside of the robot, freeing up the entire deck for your choice of electronics.
2. The choice is yours as to the location of the breadboards and depends on the microcontroller chosen. The basic kit includes the low cost but versatile Arduino Diecimilla and the image above shows possible locations of the 3 breadboards.
3. Should you choose to place the breadboards on either side of the base servo, be sure that any components connected to those boards do not contact any items connected to the servo horn. Elecontrics such as Bluetooth and wireless systems should be placed as far back on the robot as possible to avoid contact with the servo.
4. Breadboards are connected to the frame using double sided tape.
5. Ideally wires which connect to items under or on the sides of the frame should be passed through one of the six holes in the frame.
6. It is recommended that you use pre-formed jumper wires to connect components on the breadboards, and from breadboard to breadboard. Use #22 gauge wires to connect from the microcontroller to the breadboards.

Motor Controller

The two motor controllers ideally suited to the kit are the Pololu Micro Dual Motor Controller (1A) or the Pololu Low Voltage Dual Motor Controller (5A).
Follow the instructions when connecting the motor controller to your microcontroller.
Use the mini breadboards to facilitate connections.
Place the On/Off switch between the Tx of the Arduino and the Rx of the motor controllers.

REMEMBER: turn OFF the motor controller when downloading your Arduino code to the Arduino.

Electronics and Wiring

It is recommended that you assemble and test each sub-section before assembling the entire robot. This will help you troubleshoot any problems as they arise.

4.8V Battery Pack
Connect the following pins to the +4.8V (red) of the battery pack*:
Motor Supply (pin1) on Motor Controller
Servo 1 +V (red)
Servo 2 +V (red)

Connect the following pins to the GND (black) of the battery pack ("common ground")
GND on Arduino and GND (pin2) on Motor Controller
GND (black) of Servo 1
GND (black) of Servo 2

9V Battery Pack
Connect the +9V (red) of the 9V battery to the Vin of the Arduino
Connect the GND (black) of the 9V battery to the GND of the Arduino
When using the 9V battery to power the Arduino, change the jumper on the Arduino from usb to ext (external).

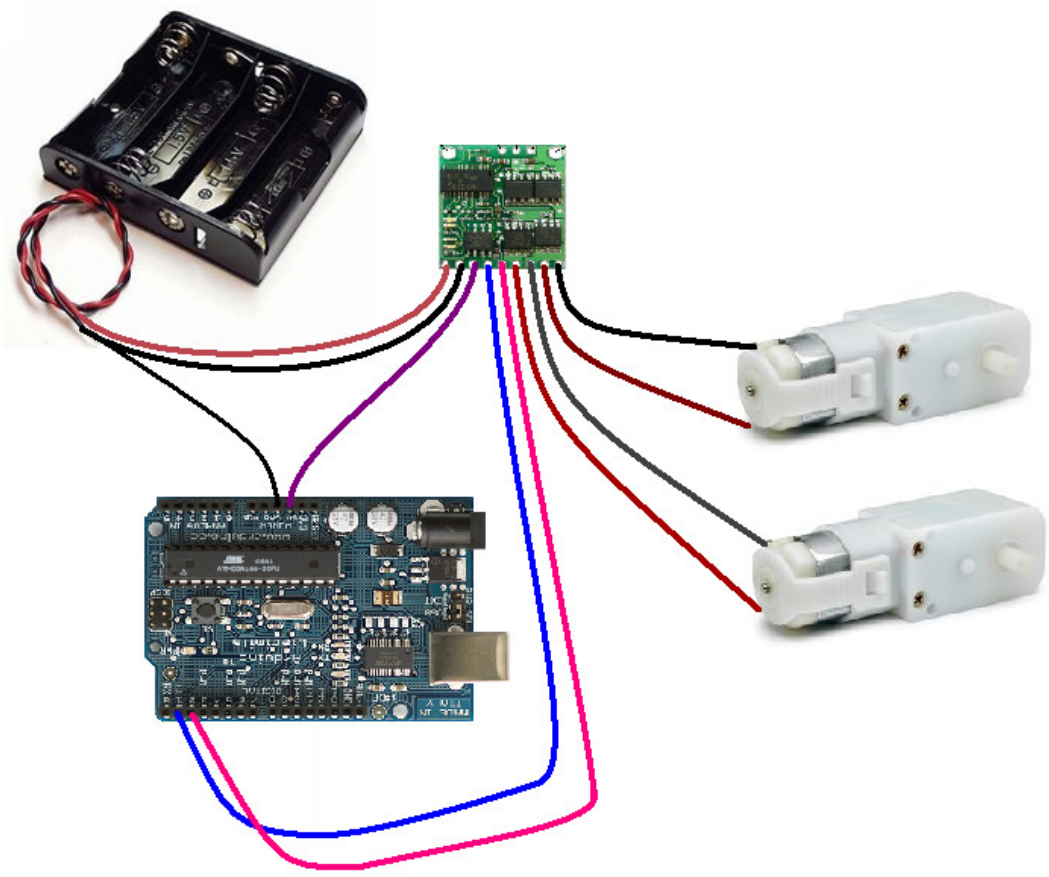
Motor Controller
Connect the +5V (or 3.3V) from Arduino to Logic Supply on Motor Controller
Connect the Tx (pin1) from Arduino to Logic Supply on Motor Controller
Connect a Digital pin (any) from Arduino to Reset pin on Motor Controller
Motor 1 Positive on Motor Controller to Motor 1 Pin
Motor 1 Negative on Motor Controller to Motor 1 Pin
Motor 2 Positive on Motor Controller to Motor 2 Pin
Motor 2 Negative on Motor Controller to Motor 2 Pin

Servos
Connect each Servo Motor Signal to a digital pin on the Arduino
Note: If the servos are connected directly to the Arduino, they may display erratic behavior when uploading code to the Arduino.

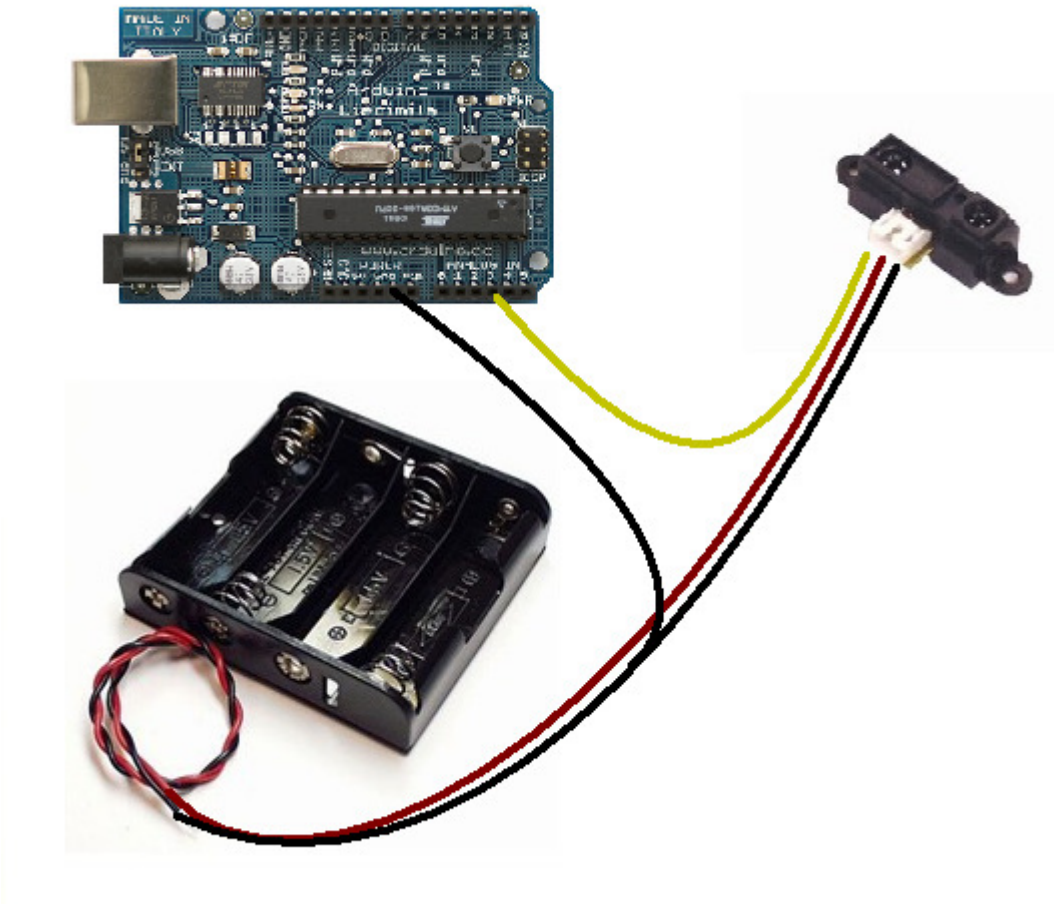
On/Off switch
Place the On/Off switch between the Tx pin of the Arduino and the motor controller Rx; this ensures that when downloading a program, only the Arduino is powered.

Support

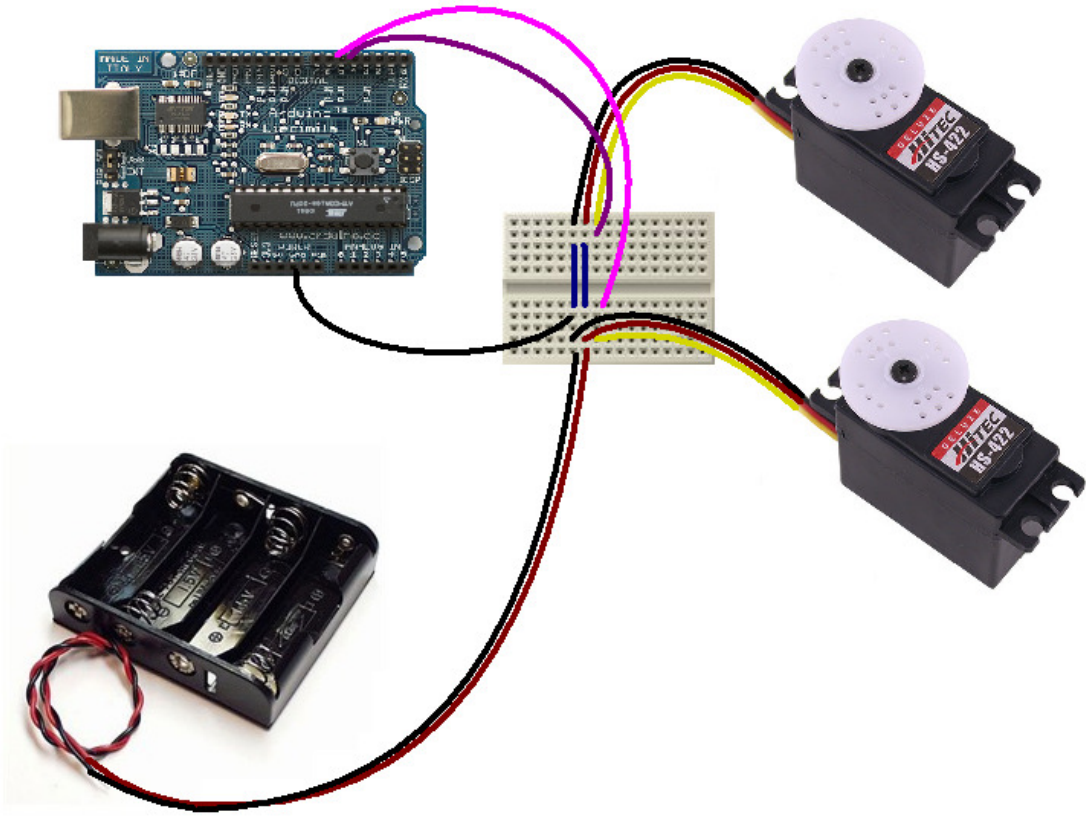
If you are missing parts: http://robotshop.helpserve.com/
For technical support: http://forum.robotshop.ca
To purchase additional or replacement parts: www.robotshop.com



Remember: common ground



Remember: common ground



Remember: Common ground.

/*

Arduino Code

The following demo code is complied in Arduino (www.arduino.cc) and uses two subroutines. You are free to copy/paste the code into the Arduino compiler.
Ensure the motor controller is connected properly before use.
The serial data line of the motor controller should be connected to pin 1 (Tx) on the Arduino.
*/

```
int servopulse1 = 1250;        //test servo tilt position (0deg =0 to 180deg =1500)
int servopulse2 = 1500;        //test servo pan position (0deg =0 to 180deg =1500)
int servopin1 = 9;             //yellow wire from servo 1 to digital pin 9
int servopin2 = 10;            //yellow wire from servo 2 to digital pin 10
int motor_reset = 2;           //motor reset pin connected to digital pin 2

void setup()
{
  pinMode(motor_reset, OUTPUT);          //sets pin as output
  pinMode(servopin1, OUTPUT);            //sets pin as output
  pinMode(servopin2, OUTPUT);            //sets pin as output
  //digitalWrite(motor_reset, LOW);      //do not activate motor driver
  Serial.begin(9600);                    //communication at 9600 baud

// reset motor controller
  digitalWrite(motor_reset, LOW);
  delay(50);
  digitalWrite(motor_reset, HIGH);
  delay(50);                    // reset delay
}


void loop()
{
  servoposition();              // subroutine servoposition
  motorcontrol();               // subroutine motor control
}

//subroutine servoposition
void servoposition()
{
  digitalWrite(servopin1, HIGH);      // Start the pulse to servo 1
  delayMicroseconds(servopulse1);     // Length of the pulse sets the servo position
  digitalWrite(servopin1, LOW);       // Stop the pulse

  digitalWrite(servopin2, HIGH);      // Start the pulse to servo 2
```

```
  delayMicroseconds(servopulse2);     // Length of the pulse sets the motor position
  digitalWrite(servopin2, LOW);       // Stop the pulse
}


//subroutine motor control
void motorcontrol()
{
//left motor
unsigned char buff1[6];
  buff1[0]=0x80;                  //start byte specific to Pololu motor controller
  buff1[1]=0x00;                  //Device type byte specific to Pololu controller
  buff1[2]=0x01;                  //Motor number and direction byte; motor one =00,01
  buff1[3]=0x7F;                  //Motor speed "0 to 128"  (ex 100 is 64 in hex)
for(int i=0;i<4;i++) {Serial.print(buff1[i],BYTE);}

//right motor
unsigned char buff2[6];
  buff2[0]=0x80;                  //start byte - do not change
  buff2[1]=0x00;                  //Device type byte
  buff2[2]=0x03;                   //Motor number and direction byte; motor two=02,03
  buff2[3]=0x7F;                  //Motor speed "0 to 128"  (ex 100 is 64 in hex)
for(int i=0;i<4;i++) {Serial.print(buff2[i],BYTE);}

}
```